

10/587829

SHOE HAVING AN INNER ADAPTABLE SURFACE ON WHICH THE
WEARER'S FOOT RESTS

The present invention relates to a shoe, of walking or sports type, in accordance with the introduction to the main claim.

A shoe is known to comprise a sole, generally constructed of an elastomer material, for example rubber or EVA, with which a vamp is associated to receive a user's foot. The user's plantar region rests on a resting surface of the sole; an innersole, the top of which contacts the foot, is preferably disposed between the sole and the user's foot, to define said resting surface.

Shoes are known in which the resting surface for the user's foot can be shaped to mirror the user's plantar region. Generally, this shape is permanently assumed when the user uses the shoe for the first time.

The resting surface for the user's foot is usually shaped to mirror the plantar region thereof by using methods comprising the provision in the sole of a plurality of containers, a first container containing a first material of a two-phase synthetic resin foam product and at least a second container containing a second material of this product. On forming the sole, these containers are positioned well separate from each other; however when the second container, made of a frangible material, is subjected to a suitable pressure, the second material of said product contained therein mixes with the first material present in the first container; this mixing results in a chemical reaction by which the two originally liquid materials define a substance which solidifies within a short time. This resin foam substance (or product) inserted into the first container (the only

container remaining within the sole) enables this latter to assume a shape corresponding to the user's plantar region when the container is inserted into the shoe during the curing period of the foam substance. In this manner the foot resting surface within the shoe assumes the specific shape of the plantar region of the user wearing it.

A first example of such a shoe is described in DE3114944 and describes a shoe having an innersole provided with a flexible envelope containing a plastic resin, in particular a polyurethane foam (or products deriving from polyfunctional isocyanates with polyalcohols) or a silicone rubber (for example of SIR type). A number of containers of a hardening agent and, preferably, of a hardening accelerator are dispersed within this envelope, said agent being chosen such that on mixing with the plastic resin present in the first container it causes this resin to more or less rapidly cure. This curing results in an innersole having the consistency of an elastomer and shaped as the foot of the user wearing the shoe during this process. The plurality of second containers are ruptured by subjecting the sole to a suitable pressure or by heat before inserting the innersole into the shoe; in any event, the curing time for the plastic resin is such that it terminates after the user has put the shoe on.

Although the aforesaid prior patent enables an innersole to be obtained shaped as the user's plantar region, it has the drawback that this shape is difficult to obtain because of the dispersion of the various containers containing the hardening agent within the container containing the plastic resin. To achieve a suitable distribution of the hardening agent within the plastic resin, all the containers of this agent must be ruptured such as to cause this agent to disperse uniformly within said resin. As the containers

of this agent are numerous and are dispersed within the resin container, they may rupture incompletely so that part of said resin, not reached by any hardening agent, remains yieldable even after the innersole has been inserted into the shoe. Consequently the resting surface of the user's foot does not become completely shaped as the user's plantar region and moreover, by presenting yieldable portions, does not offer adequate user comfort during use of the shoe.

DE2926246 describes a shoe presenting a sole, a vamp and an innersole containing silicone material in plastic form (unactivated material). The innersole is shaped substantially as a container for this silicone material and presents an aperture through which a drying or hardening agent can be inserted which, on mixing with the silicone resin, causes it to harden or cure (in other words, it activates the resin). The hardening material is inserted into the innersole by a syringe.

After injecting this material, the innersole is suitably manipulated and inserted into the shoe above the sole. During the time in which the silicone material remains active, the shoe is worn by the user so that hardening of this material terminates under the pressure of the user's foot, this pressure shaping the foot in accordance with the plantar region.

This prior patent uses a syringe for inserting the hardening material into the innersole, a solution which is hardly practical. Moreover as a syringe is used, one of these substances may emerge through the point in which the syringe has been inserted into the innersole, at least during the commencement of mixing between the silicone material and the hardening agent while manipulating the innersole.

US3985853 describes a further solution relative to an innersole shapeable according to user's plantar region.

US3736673, which is the document of the state of the art considered the closest to the present invention, describes a shoe provided with an innersole able to assume generally the shape of a user's plantar region. A second innersole is provided removably interconnected to and at least partly disposed below the first innersole, this second innersole having generally a U-shape and extending from that part of said first innersole normally positioned between the metatarsal region of said foot and the shoe heel region. Below the second innersole there is provided a U-shaped bag element fixed to said second innersole, said element presenting a pair of parallel arms, symmetrically disposed about an interconnection portion. Within these arms there are disposed frangible containers, each containing a material defining a phase of a two-phase rigid foam product. The two materials are manually mixed by rupturing the relative containers before inserting the second innersole into the shoe. Mixing takes place within the bag element and results in the creation, within the interconnection portion, of foam which rises into the U-shaped bag element and fills it completely. After this insertion the shoe is worn so that the pressure of the overlying foot results in expansion of the foamed system and its hardening, to assume the shape of the plantar region. This US patent presents various drawbacks including the fact that when the innersole is inserted into the shoe it is no longer separable from this latter. Moreover, because of the position of the containers of the two materials defining the foam product, rupturing the containers may not lead to compete mixing of these materials within the transverse portion of the

U-shaped element, with consequent incomplete foam creation within it. Consequently, the U-shaped element is unable to correctly assume the shape of the user's plantar region so that the final shoe does not attain the objects of the patent, i.e. the shoe does not present an innersole shaped as the user's foot. Indeed, the possible incomplete mixing of the two materials of the foam product, resulting from the arrangement of the relative containers at the opposing arms of the U-shaped element, can result in the creation of parts of different rigidity within the element below the user's foot. These parts, if thick, can also cause pain to the user wearing the shoe; if the user is a child, an incorrect resting surface for the foot inside the shoe on a surface on which the child walks can cause microtraumas within the child's foot structure and within the lower limbs in general, microtraumas which could also lead to subsequent walking problems for the child.

In addition, as the second innersole presents a U-shaped element which can assume the shape of the user's foot, the innersole may not be able to completely copy the shape of that plantar region between the metatarsal region and the heel. In this respect, because of the U-shape of the deformable element, if there is any incorrect mixing of the two materials of the foam system, the innersole could yield at the region between the U-shaped arms of said element, with consequent lack of adequate support for the overlying foot portion. Again in this case the aforesaid problems related to the incomplete mixing of said materials could therefore appear. The solution of this prior patent is also difficult to implement because of the need to create, within the arms of a U-shaped bag element, separate containers for the two materials of the foam product.

An object of the present invention is to provide an improved shoe in which the resting surface for the foot of the user wearing it can be effectively shaped as the plantar region.

A particular object of the invention is to provide a shoe which is of simple construction and can be obtained at a lower cost than equivalent known shoes.

Another object of the invention is to provide a shoe which, even after various uses, is able to offer a new resting surface adapted to the user's foot if the previous resting surface has lost the previously given shape.

These and further objects which will be apparent to the expert of the art are attained by a shoe in accordance with the accompanying claims.

The present invention will be more apparent from the accompanying drawings, which are provided by way of non-limiting example and in which: Figure 1 is an exploded perspective view of a shoe according to the invention;

Figure 2 is a perspective view of part of a variant of the shoe according to the invention;

Figure 3 is a section on the line 3-3 of Figure 1;

Figure 4 is a section similar to that of Figure 3, but of another variant of the invention; and

Figure 5 is a section on the line 5-5 of Figure 4.

With reference to said figures, the invention provides a shoe indicated overall by 1 in Figure 1. It comprises a sole 2 on which a vamp 3 is disposed to define the seat for the foot of the user wearing the shoe. With a lower face 2A of the sole there are associated usual studs 4 formed by injection moulding onto the sole. Said sole face 2A, which contacts the

ground, can evidently be of different shape while remaining within the scope of the present invention.

When inside the shoe the user's foot lies on a resting surface preferably defined by the upper side 4 of an innersole 5 lying on an upper face 2B of the sole 2.

With the sole 2 there is associated a first container 8 in which a first material is disposed defining one phase of a two-phase synthetic resin foam product, a second material defining the second phase of this product being contained in a second container 9. This second container 9 is frangible under pressure to enable said materials to be mixed together and allow the creation, by chemical action, of the resin foam product within the container 8.

According to the invention, the first container 8 contains the second container 9 which together define an insert located inside the sole 2. In this manner, the second material of the foam product present in the second container 9 can adequately mix with the first material of this product contained in the first container when this second container 9 ruptures. As the second container 9 is present within the first container 8, the emergence of the second material from said second container enables this material to reach every point of the first container and mix with the first material present therein. By this means, the resin foam product exists at every point of the container 8.

More specifically, the first material contained in the first container 8 is a silicone resin for example of the type described in DE314944, or a silicone which vulcanizes at ambient temperature of the type described, for example, in US3985853. A further example of the first material of the

aforesaid resin foam product is that of a two-component silicone currently produced by Rhodia Silicone, of which this material forms the first component.

The first material is contained in the first container 8 formed in known manner, for example of polyurethane (advantageously transparent), of thickness between 200 and 400 microns. In any event, the container 8 has a thickness such as to withstand a pressure of at least 100 kg/cm^2 without rupturing.

The second material of the resin foam product is a suitable known hardening agent, possibly associated with a suitable accelerator, usable with the first material to achieve solidification after its mixing with this latter. An example of this second material can be found in DE3114944.

This second material is contained in the second container 9, also made of plastic or polymer material, for example polyethylene, but having a smaller thickness than the first container 8. For example, the thickness of the second container can be between 40 and 50 microns. In any event, the thickness of the container 9 is such that it can be ruptured or opened by acting on it with a stress or pressure at most equal to 5 kg/cm^2 and preferably $2\text{-}3 \text{ kg/cm}^2$.

To enable the second material to reach every point of the first container after the second container 9 has been ruptured, this second container has an elongate shape and is disposed along the longitudinal axis W of the insert 10. Advantageously, said second container has a branched structure presenting a plurality of arms or branches 13 extending from a trunk 14, said trunk being disposed along the axis W and the branches 13 projecting from it towards the edges of the first container 8.

As stated, the second container 9 is contained in the first. Preferably, as shown in Figure 3, this container is completely embedded within the first container 8 with the material present in this latter completely wrapping the second container 9 on all sides. Alternatively, the second container 9 can be in the form of a bag insertable into the first container 8 and presenting opposing sidepieces 9A, 9B brought together and bonded perpendicular to a plane containing the insert 10, said sidepieces being hence perpendicular to a free face 8A of the container 8 (see Figure 5).

According to another characteristic of the invention, the insert 10 is positioned in a seat 11 provided in an intersole 17 present between the innersole 4 and the sole 2. The seat 11 has the shape of the insert 10 and completely contains it. The intersole 17 is made of any elastomer material and is also to be considered part of the sole 2, even if it is preferably and advantageously removable from the interior of the vamp 3. However the intersole 17 can also be made of a material other than an elastomer, for example a natural material such as cork.

As an alternative, the seat 11 can be formed directly within the sole 2, as visible in Figure 2. Again in this case the seat 11 receives the insert 10 and has the shape essentially of the first container 8 which adapts to the interior of said seat 11.

By virtue of the present invention, a shoe is obtained having a resting surface for the foot contained in it which can be adapted to assume the shape of its plantar region. It will now be assumed that the invention is to be used to obtain this adapted resting surface. To achieve this, pressure is generated on the second container 9 or rather in correspondence with different portions of this container, in order to rupture it and enable the

contained material to emerge therefrom. As a result of this emergence said material becomes distributed randomly about said container 9; by applying suitable manipulation this material becomes suitably distributed within the first container to reach every point thereof and to mix and interact with the first material contained therein. This operation must be carried out within a predetermined time limit which is a function of the type of materials defining the resin foam system used; for example, this time may be two minutes, within which time the second material becomes distributed within the first container 8.

After this manipulation, the insert 10 is positioned in the seat 11 inside the shoe; the innersole 4 is placed on it to cover it completely. When the shoe is worn, the user's weight produces the final shape of the resin foam product present in the insert 10, which hence assumes the shape of the user's plantar region.

It should be noted that the insert 10 lies in the seat provided in the sole 2 such as to occupy a space corresponding to that part of the plantar region between the foot metatarsal region and the heel.

The invention is simple to implement and gives certain results. This is due to the aforescribed arrangement of the containers 8 and 9. In addition, as the insert 10 is removable from the shoe, it can be replaced by a new insert (still to be shaped) whenever it becomes damaged with time, or with continued use of the shoe it no longer correctly matches the user's plantar region.

Different embodiments of the invention have been described, however others can be obtained (for example by suitably choosing the material of the resin foam product to be used or the shape of the single container 9

placed in the single container 8) while remaining within the scope of the invention as defined in the accompanying claims.